

Remarks*Extension of Time*

Submitted herewith is a Request for Extension of Time providing additional time for responding to the Office Action of August 06, 2004.

Amendments

Claims 11, 38, 55 and 72 have been amended in accordance with the Examiner's suggestion to provide antecedent support for the phrase "hydroxide or alkoxide of the alkali metal or alkaline earth metal catalyst" recited in each of those claims. The phrase "wherein the aldol catalyst solution comprises a solution of an alkali- or an alkaline-earth metal hydroxide or alkoxide" has been added to each of the amended claims. The phrase added (to provide the needed antecedent support) is supported by applicants' disclosure in general and by original Claims 10, 37, 54 and 71 in particular. The Examiner's assistance is appreciated.

Claims 1, 31, 48 and 65 have been amended by the addition of the phrase:
wherein the recycling is carried out at a recycle ratio of the volume of liquid reactor effluent recycled back through the reactor, with respect to the volume of the portion of the liquid reactor effluent that is not recycled, of at least about 1 to 1

at the end of each of those claims. This amendment constitutes the incorporation of each of Claims 2, 32, 49 and 66 into each of Claims 1, 31, 48 and 65, respectively. The above-requested amendments include the cancellation of Claims 2, 32, 49 and 66

Claim Rejection – 35 USC § 112

The amendments requested hereinabove are believed to overcome the rejection based on 35 USC 112, second paragraph. Accordingly, the withdrawal of the § 112 rejections is respectfully requested.

Claim Rejection – 35 USC § 103

Claims 1, 5-7, 9-21 and 23-40 stand rejected as unpatentable under 35 USC 103(a) in view of the disclosure of Muthusamy et al US Patent 5,583,263 and further in view of the disclosure of Letts US Patent 4,739,122. Claims 31, 34, 35, 37-42 and 44-47 stand rejected as unpatentable under 35 USC 103(a) in view of the disclosure of Muthusamy et al US Patent 5,583,263 and further in view of the disclosure of Letts US Patent 4,739,122. Claims 48, 51, 64-59 and 61-64 stand rejected as unpatentable under 35 USC 103(a) in view of the disclosure of Muthusamy et al US Patent 5,583,263 and further in view of the disclosure of Letts US Patent 4,739,122. Claims 65, 68, 69 and 71-80 stand rejected as unpatentable under 35 USC 103(a) in view of the disclosure of Muthusamy et al US Patent 5,583,263 and further in view of the disclosure of Letts US Patent 4,739,122.

The above rejections under §103(a) seem to be based (1) solely on the disclosure of Muthusamy et al US 5,583,263 and (2) on the combined disclosures of Muthusamy et al and Letts US 4,739,122. Reconsideration of the §103(a) obviousness rejections is respectfully requested.

The processes defined by the claims of the present application are one-step processes for producing a ketone comprising the steps of:

feeding an aldol catalyst solution, a lower molecular weight aldehyde, and a lower molecular weight ketone, through a reactor provided with a solid hydrogenation catalyst and hydrogen gas;

recovering a liquid reactor effluent containing the higher molecular weight ketone as a reaction product; and

recycling a portion of the recovered liquid reactor effluent back through the reactor.

The Muthusamy et al reference is concerned with and describes only a multi-step process for co-producing methyl n-amyl ketone and methyl isobutyl ketone. The Muthusamy et al reference requires at least three (3) distinct and separate steps, i.e.,

- (1) reacting a feed of dimethyl ketone and n-butyraldehyde in the presence of a particular fixed bed [solid] aldol catalyst to produce a first intermediate mixture. A hydroxy-ketone;
- (2) dehydrating the first intermediate mixture in the presence of steam and a catalytic quantity of a member of the group consisting of H₂SO₄, NaHSO₄, and sulfonic acid resins to produce a second intermediate mixture, an unsaturated ketone; and

- (3) hydrogenating the second intermediate mixture in the presence of hydrogen and a hydrogenation catalyst to produce a mixture of methyl iso-butyl ketone and methyl n-amyl ketone.

The reaction, dehydration and hydrogenation steps of the Muthusamy et al process are carried out separately and in separate units of equipment. It is applicants' respectful submission that the multi-step process described by the Muthusamy et al reference cannot suggest or otherwise render obvious applicants' novel single step process.

The Muthusamy et al reference does mention one-step reactions in column 2 in the Background of the Invention section of the reference. However, this Background of the Invention description of such reactions does not provide sufficient detail to suggest or otherwise render obvious applicants' novel process.

The Muthusamy et al reference also fails to disclose or suggest recycling a portion of the recovered liquid reactor effluent back through the reactor as is specified by the claims under consideration. Applicants' disclosure clearly shows the benefits offered and advantages achieved, e.g., improved selectivity, by recycling a portion of the liquid reactor effluent back to the reactor. The Office Action concedes, e.g., on page 5, that Muthusamy et al do not disclose or suggest the recycle feature of applicants' novel process. Thus, applicants believe that the § 103(a) rejections are not supported by the Muthusamy et al reference.

Reconsideration of the § 103(a) rejections based on the combined disclosure of the Muthusamy et al reference and Letts US Patent 4,739,122 is respectfully requested. The process disclosed by Muthusamy et al involving three (3) distinct and separate steps is discussed above.

The Letts reference discloses a cross-aldol condensation process wherein the reactants are fed to a fixed-bed catalyst. No basic aldol condensation catalyst is employed and conversion rates are relatively low, Example 1 gives a butyraldehyde conversion of only 50.8%. Thus, as mentioned in Example 1 of Letts:

Unreacted acetone and butyraldehyde along with isopropanol and butanol can be recycled back to the reactor.

The process described in the Letts reference is concerned primarily with the catalyst employed. As mentioned, the Letts process does not employ a basic aldol

condensation catalyst solution as is specified in the claims of the present application. It is apparent the Letts process is substantially different from the processes of both the present application and the process described by the Muthusamy et al reference.

Applicants' novel processes involve one-step processes for producing a ketone comprising the steps of:

- feeding an aldol catalyst solution, a lower molecular weight aldehyde, and a lower molecular weight ketone, through a reactor provided with a solid hydrogenation catalyst and hydrogen gas;
- recovering a liquid reactor effluent containing the higher molecular weight ketone as a reaction product; and
- recycling a portion of the recovered liquid reactor effluent back through the reactor.

The use of an aldol catalyst solution provides both advantages, e.g., high conversion rates, and problems, e.g., lower selectivity. Applicants have discovered that the selectivity problem can be overcome to a substantial extent by recycling a portion of the recovered liquid reactor effluent, i.e., the hydrogenated condensation product, back through the reactor. The advantages achieved by the product recycle are demonstrated by applicants' experimental work report in the present application. More specifically, the advantages of the claimed processes are shown in Table 2 on page 28 of applicants disclosure:

Table 2. Results from Examples 2, 3, 4, 5, and 6

	Example 2	Example 3	Example 4	Example 5	Example 6
	Plug Flow	With 10 L/hr Recycle	With 20 L/hr Recycle	With 30 L/hr Recycle	With 40 L/hr Recycle
MAK Product Composition From:					
Recycle Ratio	0	7.6	15	23	30
Water	8.78	9.94	9.63	9.59	9.48
Acetone	29.7	22.12	20.4	19.9	18.2
n-butyraldehyde	0.11	0.55	0.24	0.49	0.35
Methyl Isobutyl Ketone	0.23	0.58	0.56	0.58	0.52
Methyl Amyl Ketone	27.01	41.62	44.28	45.11	46.1
3-heptene-2-one	1.01	1.34	1.17	1.4	1.39
2-ethyl-hexaldehyde	11.03	1.81	1.617	0.977	0.90
High and low boilers	11.32	4.84	3.86	4.48	4.11
n-butyraldehyde conversion	99.74	98.68	99.43	98.83	99.18
Selectivity	38.4	62.97	66.00	67.91	68.2

As can be seen from above Table 2, the conversion [selectivity] to the desired methyl amyl ketone is increased substantially while the conversion [selectivity] to the undesired 2-ethylhexaldehyde and the high/low boilers is decreased substantially. These improvements are achieved while maintaining an average butyraldehyde conversion rate of over 99%.

Applicants respectfully submit that the Muthusamy et al reference and the Lett reference, considered individually or in combination, do not suggest applicants' novel process. The processes of the cited prior art differ from the process of the present application in one or more materials features. Furthermore, nothing disclosed in the references suggests the significant advantages provided by the process of the present patent application.

Although applicants believe that the § 103(a) rejections set forth in the Office Action are not supported by the prior art and should be withdrawn, applicants have amended Claims 1, 31, 48 and 65 to advance and promote the prosecution of the present application. Claims 1, 31, 48 and 65 have been amended by the addition of the phrase:

wherein the recycling is carried out at a recycle ratio of the volume of liquid reactor effluent recycled back through the reactor, with respect to the volume of the portion of the liquid reactor effluent that is not recycled, of at least about 1 to 1


at the end of each of those claims. This amendment constitutes the incorporation of each of Claims 2, 32, 49 and 66 into each of Claims 1, 31, 48 and 65, respectively. Since the Office Action states on page 14 that Claims 2, 32, 49 and 66 (and some additional claims) are allowable if written in independent form, amended Claims 1, 31, 48 and 65, and all of the other dependent claims, should be allowable.

Summary

In summary, it is applicants' respectful submission that the rejections based on 35 U.S.C. 112 have been overcome by the amendments requested herein and that the rejections based on 35 USC 103(a) are not supported by the cited prior art. Accordingly, the withdrawal of the rejections and an early allowance of the application are earnestly solicited.

Respectfully submitted,

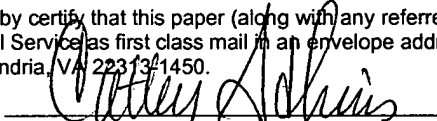
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CERTIFICATE OF MAILING UNDER 37 CFR 1.8(a)

I hereby certify that this paper (along with any referred to as being attached or enclosed) is being deposited with the United States Postal Service as first class mail in an envelope addressed to: the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.


Cathy Adkins

1/18/05

Date